

## CABLE END CONNECTOR

### CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application is a continuation-in-part (CIP) of U.S. patent application serial No. 10/317,830, titled by CABLE ASSEMBLY, filed on December 11, 2002; and U.S. patent application serial No. 10/377,853, titled by CABLE ASSEMBLY WITH LATCH MECHANISM, filed on February 28, 2003; and U.S. patent application serial No. 10/600,517, titled by CABLE ASSEMBLY WITH IMPROVED GROUNDING MEANS, filed on June 19, 2003, all are made by the same inventor and assigned to the same assignee. The disclosure of the above identified applications is incorporated herein by reference.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0002]** The present invention is related to a cable end connector, and especially to a cable end connector having removable screws for securing the cable end connector to a complementary connector.

#### 2. Description of the related art

**[0003]** With the development of communication and computer technology, high density electrical connectors, for example male and female connectors, are desired to construct a large number of signal transmitting paths between two electronic devices where the male and female connectors are mounted. Latch or screw means are required to keep the male and female connectors mated to resist

vibration which may disengage the male connector from the female connector.

**[0004]** US patent No. 5,387,123 discloses an electrical connector having a pair of moveable latches at opposite sides thereof. Each latch has an elastic means which, when not be pressed, can drive the latch end to engage with a corresponding member of the complementary connector. However, the latch means is not reliable in bad vibration circumstance. US patent No. 5,725,387 discloses a cable end connector having a pair of screws at opposite sides thereof. The screws have threaded heads that are operable to engage with corresponding elements of a complementary connector after the cable end connector mates with the complementary connector. The screws have good performance of resisting vibration. However, as disclosed in the 5,725,387 patent, the screws are molded in a cover, so when the screws become worn, they cannot be replaced by new ones without destroying the cover, therefore, the cable end connector become useless.

**[0005]** Therefore, an improved cable end connector is desired to overcome the above disadvantages.

## SUMMARY OF THE INVENTION

**[0006]** An object of the present invention is to provide a cable end connector having removable screws for securely joining the cable end connector with a complementary connector.

**[0007]** To obtain the above objects, an electrical connector includes a front

housing portion, a rear housing portion engageable with the front housing portion, a contact module sandwiched between the front and rear housing portions and four screws retained by the front and rear housing portions. The front housing portion provides four projections at respective corners thereof and the rear housing portion provides four ear portions at respective corners thereof in accordance with the corresponding projections. Each projection defines a through-hole therethrough and each ear portion defines a U-shaped cutout. Each screw includes a threaded head, an operation end at opposite ends thereof and a pole between the threaded head and the operation end. A ring is formed at a middle section of the pole. The screw is movably received in the through-hole and the cutout when the front housing portion engages with the rear housing portion. The through-hole includes a first segment and a second segment with a shoulder being formed at the conjunction of the first and second segments. The ring has a dimension larger than that of the first segment and the cutout but smaller than the second segment such that the ring is movable between the shoulder and the ear portion. Since the front housing is disengageable from the rear housing portion by simply release the latches of the rear housing portion from the front housing portion, it is very convenient to disassemble the screws from the front and rear housing portions.

**[0008]** Other objects, advantages and novel features of the invention will become more apparent from the following detailed description of the present embodiment when taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is an exploded perspective view of an electrical connector of the present invention;

[0010] FIG. 1A is an enlarged view of a circled part that is labeled by 1A in FIG. 1;

[0011] FIG. 2 is an enlarged perspective view of a screw in FIG. 1;

[0012] FIG. 3 is an assembled rear perspective view of the electrical connector in FIG. 1;

[0013] FIG. 4 is a cross-sectional view of the electrical connector taking along line 4-4 in FIG. 3; and

[0014] FIG. 4A is an enlarged view of a circled part that is labeled by 4A in FIG. 4.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] Referring to FIG. 1, an electrical connector 1 of the present invention includes a first or front housing portion 10, a second or rear housing portion 12 attachable to the front housing portion, a contact module 14 retained between the front and rear housing portions and screws 16 attachable to the front and rear housing portions for securing the electrical connector 1 to a complementary connector (not shown). The electrical connector 1 is somewhat disclosed in the

U.S. patent application serial No. 10/317,830, titled by CABLE ASSEMBLY, filed on December 11, 2002; and the U.S. patent application serial No. 10/377,853, titled by CABLE ASSEMBLY WITH LATCH MECHANISM, filed on February 28, 2003; and the U.S. patent application serial No. 10/600,517, titled by CABLE ASSEMBLY WITH IMPROVED GROUNDING MEANS, filed on June 19, 2003, all are made by the same inventor and assigned to the same assignee, which are incorporated herein by reference (these applications will be indicated by prior U.S. patent applications hereinafter ).

[0016] The contact module 14 includes a number of sub-PCBs 18 arranged side-by-side and a number of cables 20 with conductive cores connecting with conductive traces on the sub-PCBs 18 (not shown). The contact module 14 is disclosed in the prior U.S. patent applications and will not be described here in detail for concision.

[0017] The front housing portion 10 defines a number of parallel passageways 22 through front and rear ends 24, 26 thereof for partially receiving the respective sub-PCBs 18. There are four projections or stations 28 on upper and lower surfaces of the front housing portion 10 and each projection is generally located at a particular one of the corners of the front housing portion 10. As shown in FIGS. 4 and 4A, each projection 28 defines a through-hole 30 extending generally parallel with the passageway 22. The through-hole 30 includes a first segment 32 and a second segment 34 along the extending direction thereof, wherein the second segment 34 is closer to the rear end 26 of the first housing portion 10 than the first

segment 32. The second segment 34 is of a larger size than the first segment 32 such that a shoulder 36 is formed at the conjunction of the first and second segments 34, 36. As a result, the screw 16 can only be inserted into and withdrew from the through-hole 30 from the rear end 26.

**[0018]** The rear housing portion 12 includes a pair of frames 38 and defines a window 40 therethrough after the frames 38 engage with each other. Four latches 42 forwardly extend from a front edge 44 of the rear housing 12 for attaching the rear housing portion 12 to the front housing portion 10. The rear housing portion 12 forms four ear portions 46 on top and bottom surfaces thereof. The ear portions 46 are particularly located at respective corners of the rear housing portion 12. Referring to FIG. 1A, each ear portion 46 defines a generally U-shaped cutout or aperture 48 that has an exit 50 at one side thereof for entrance of the screw 16.

**[0019]** Referring to FIG. 2, each screw 16 includes an operation end 52 at a rear end thereof, a threaded head 54 at a front end thereof, a pole 56 between the operation end 52 and the threaded head 54, and a ring 58 generally at a middle section of the pole 56. The operation end 52 forms keys on an outer surface thereof for facilitating operating the screw 16. The ring 58 has a larger diameter than the pole 56.

**[0020]** Referring to FIGS. 1, 4 and 4A, in assembly, the frames 38 are attached to each other to sandwich the contact module 14 therebetween with the cables 20 exiting from the window 40. Each screw 16 is laterally attached to a respective

ear portion 46 via the exit 50 with the operation portion 52 and the ring 58 located at opposite sides of the respective ear portion 46. The contact module 14 together with the rear housing portion 12 and the screws 16 are assembled to the front housing portion 10 with the latches 42 engaging with the front housing portion 10. As particularly illustrated in FIGS. 4 and 4A, the threaded head 54 is forward inserted through the through-hole 30, the operation end 52 is located behind the ear portion 46 while the ring 58 is moveably received in the second segment 34 of the through-hole 30. The ring 58 is limited to be moveable between the shoulder 36 and the ear portion 46 because the dimension of the ring 58 is smaller than that of the second segment 34 but larger than that of the first segment 32 and that of the U-shaped cutout 48.

**[0021]** The electrical connector 1 of the present invention has several advantages over the prior art. First, since the housing includes several parts that are engageable with each other, the assembly of the contact module 14 to the housing becomes much easy. Second, the screws 16 may be disassembled from the projections 28 and the ear portions 46 by simply disengaging the latches 42 from the front housing portion 10 which will not destroy the housing. Third, the projections 28 are located on out surface of the front housing portion 10, so the screws 16 will not disturb the arrangement of contact module.

**[0022]** It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the

invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.